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branches of investigation, and then it will excite no more doubt as to a clergyman's orthodoxy to find that he admits the possibly remote origin of man by a law of nature, than that he believes the sun to be the centre of the solar system.

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### THE STRUGGLE OF MAN WITH NATURE.\*

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AN English naturalist, Darwin, has attempted to explain in a very simple way the immense variety of animals and plants surrounding us, as being the result of constant changes in the course of long periods, by the struggle for existence, which causes, that in this struggle that which is imperfect perishes, whilst what is stronger and better survives. Although such an assumption of natural selection is insufficient to explain the gradual progress which natural science must assume in the formation of plants and animals, including man, still it is unquestionably one of the many causes which have effected a gradual development and great variation in all creatures of nature. Life in nature is not so peaceable as the sight of a fine landscape at sunset might lead us to believe. Contest and rivalry prevail universally. Were not the vital force constantly called upon to resist, it would relapse into inactivity. Whatever is to persist must be in motion ; the stagnant water becomes a marsh, whilst the violent torrent tolerates no life and carries off rocks.

Not animals only, plants also struggle with each other. Were not the weeds in our gardens being constantly destroyed, the wild growing plants would soon displace our nurselings ; thus, the heath and the forest would overspread our acres were they not kept at a proper distance. In primitive forests, creepers surround the mighty trunk, and finally the parasite surrounding it like ivy, embraces only the dead trunk which it has suffocated.

How many plants must perish in order that an animal might live, and how do animals limit their own number ! Herbivora become the booty of carnivora, by which the latter become the protectors of the vegetable world ; if the carnivora are prevented from increasing, then the number of herbivora multiplies. Every living creature has its enemy. A butterfly causes much destruction in the pine forests, as the caterpillar feeds on the leaves, but upon the birch tree lives its enemy the tailed wasp, which lays its eggs in that caterpillar, in the larvæ of

\* Translation of a Lecture, delivered February 1, 1867, at Düsseldorf, by Hermann Schaafhausen.

which the grubs developed from the eggs, after eating away the intestines, become crysalised, in order to reappear as young wasps.

Should man alone stand in creation not exposed to strife and struggle? Who limits him? In most cases he does it himself. Wars and battles are as old as history; man, in fact, rages against his own species as no other animal does. But even the high position man occupies as opposed to nature, and of which he considers himself the chief, is a struggle, a constant labour. In the enjoyment of a high civilisation, in the possession of that mental power, by which he has rendered the mighty forces of nature subservient to his objects—we must not forget the long and laborious path which our species, under obstructions of all kinds, had to pass over until it reached that high stage from which we now look down upon the conquered world. This consideration strengthens the feeling of human power and dignity, that man, although provided by God with the capacity of performing what he has effected, yet that the civilisation which he has reached is his own deed, the work of his own mind.

If any one doubts that human development has progressed in the course of time, the study of any part of human activity, the development of which we can trace, must convince him. The history of language, the progress of natural science, discoveries, and inventions, bear testimony to it. That in countries now inhabited by civilised peoples, savages once housed, whom the ancient historian, as it was thought in exaggeration, described as cannibals, has been recently confirmed by the finds of ancient skulls, rude stone and bone implements, all relics of the past primitive condition of our species. It strikes the student that the picture of the oldest inhabitants of Europe, that we can form from their relics, resembles that given by travellers of still existing savage tribes. We learn that one privileged portion of the human species has advanced in the path of civilisation, whilst others, who are still our brethren, have either, under the pressure of an all-powerful nature, been unable to raise themselves from want and misery; or, living under a luxuriant climate, have given themselves up merely to the gratification of the senses, and lead a life illuminated by only a feeble ray of human reason.

Has Providence indeed distributed her gifts to humanity in so unequal shares? Surely not. But the struggle of man with nature is not attended with equal success. It is as upon the race-course, all strive for the foremost place, which is only afforded to one, and many must lag behind. Many fortunate circumstances must concur before the tender plant of human civilisation can germinate, thrive, and become a stately tree, under the shade of which all people may assemble, even such as have had no share in planting the tree. Justice

is done hereby, so that the civilised man can be, and often has been, the educator and the benefactor of his miserably neglected brother.

In comparing the history of mankind to a mighty stream, political events, which for a long time have alone been considered history, are simply the ripples on the surface, which, when the storm rises, may become towering billows ; but that which gives motion to the stream is the never-resting labour of the human mind. What it has effected in liberating man from thousands of chains, which nature has put upon him, will become apparent by the comparison of various degrees of culture, which he has in the course of time successively attained, with those which he still occupies in other parts of the world, and we shall then investigate his life in the different relations in which he stands as opposed to nature.

Man struggles with the elements and with animals ; the plant, though it unresistingly affords him nutriment, yet may contain poison which threatens his life ; or failure of crops may induce famine. Man further struggles with disease and pestilence, and how much does he labour to escape the inexorable law of nature—death !

Whithersoever we turn our gaze over the great picture of his life, we find man armed against his enemies—here he succumbs, there he is victorious. Nature at first appears like a giant opposed to man. Thunder and lightning, the roar of the tempest, the surf of the sea, will strike the rudest savage with terror : he feels himself to be in the presence of a higher power, which he fears. This fear of God is the first awakening of natural religion ; for the knowledge of the goodness of God, the perception of the beneficent effects of nature, is a matured fruit of human thought. All savage peoples believe in evil spirits, who send them diseases and death ; and thus the worship of a beneficent God is not found amongst many savages. It does not exist among the Tasmanians, of whom, by the way, one individual only is left ;\* it is equally wanting among the Mincopies, the savage inhabitants of the Andaman Islands, of whom we only possess information within the last few years. It is said of the lowest tribe of the Bosjesmen in Africa, that they believe thunder to be the voice of an evil demon, on hearing which they creep out of their caves, and reply with curses. Whilst thus the savage curses during a thunderstorm, the agriculturist blesses it, when, after the noisy demonstration of the elements, the floodgates of heaven open, and the fertilising rain pours down after a long drought.

The struggles of man against the gods are subjects of ancient myths, in which natural forces are represented by gods. And the

\* “Already, in a few years, we have cleared Van Diemen’s Land of every human aboriginal.”—Knox, p. 230.

belief in a devil sprung up in heathen antiquity, pervading even the Christian period, and which, even amongst civilised nations, has given rise to the burning of witches, is nothing but misconceived nature. When a large block is found upon an extensive plain, none but the devil could have placed it there. But science has taught us that the large stones, the so-called erratic blocks, overlying the whole north-German plain, have been carried away from the glaciers of the Scandinavian mountains by the ice ; that they sank to the bottom, which subsequently became dry land. Whenever a sudden pestilence carried off men or cattle, superstition ascribed it to the devil, instead of investigating the causes of the evil and removing them. The savage is still in this condition. The priests of the sun-worshippers of tropical America who, says Scherzer, are at the same time the physicians of the people, press and suck the aching part of the patient for hours ; they swear, sigh, and tremble, making all the while the most grotesque gestures, until, at last, they draw from the mouth of the patient a black substance, which they pretend was the devil, who concealed himself in the body and caused the pain.

It must be acknowledged that the growing knowledge of nature is a growing knowledge of God, and that in this sense the kingdom of God is constantly expanding whilst that of the devil is contracting. A man in a higher stage of civilisation recognises a prevailing providence, which in order to preserve the whole destroys a part, so must he admire that divine wisdom, which has so ordained it, that nature should never cease calling forth man's force, which in this struggle and practice acquires new strength. This labour does not merely steel the body, the mind also is developed in this struggle with resisting nature, and the mind is the greatest force of man, it is only to his spirit that nature bends.

The spectacle, how natural forces threaten the life and the possessions of man is as manifold as terrifying. In some cases man is helplessly exposed to destruction ; in others he has, with wonderful ingenuity and perseverance, succeeded in protecting himself. The cyclones which devastated India last year have, according to reports from Calcutta, destroyed 60,000 individuals, most of whom were drowned in the rivers. What devastations are caused by inundations and storms ! The earth quakes, and in a few moments large cities are in ruins. Lightning may cause a destructive fire, which reduces to ashes huts and palaces ; for, as the poet says, "The elements hate man's handiwork."

The savage stands powerless before natural events which the civilised man tries to overcome ; but even he, the proud lord of nature, is frequently reminded of his impotence when natural forces

break through appointed boundaries. A few instances may show how man, only by slow degrees, arrives at successfully resisting a mighty natural force, such as that of water.

The North Sea incessantly advances towards the north-western coasts of Europe, threatening to engulf the land. Pliny, the Roman author, speaks of twenty-three islands between Texel and the mouths of the Weser and the Elbe ; at present only sixteen of them exist. Already the Cimbri and the Teutons are said to have been driven by inundations from their northern settlements. Migrating to the south, they overran the Roman empire, which finally succumbed to the repeated invasions of the German peoples. The great floods of the thirteenth century are still remembered. Successive inroads of the sea from 1277 to 1287 produced the Dollars Bay in East Friesland, more than fifty villages were thus destroyed. The great Zuyder Zee has a similar origin. Heligoland is diminishing in circumference. At one time it was a large green island, containing seven churches, and had in 1240 three parishes ; but whose country is partly below the level of the sea, has learned to construct excellent dykes, for which the Rhenish tarras provides him with good mortar. Well may it be said of him, that he snatches his land from the grasp of the sea ; he even recovers what the sea has robbed him of. By means of seventeen steam-engines, the Haarlem lake has been pumped out, and 30,000 acres of land have been recovered, which some years ago already contained one hundred and sixty-four farms, and 5,000 souls. It is also proposed to proceed in the same way in other parts of the country, by which large tracts of land, now submerged, will be laid bare. Venice the magnificent, with its palaces, is built upon piles driven through the mud of the Lagune into the solid clay beneath. A mighty stone dyke, two miles long, 30' high, 40 to 50' broad, the Murazzi, the last work of the republic, protects the city from the sea. We know not for certain what may have induced the men of a very remote period to build their habitations on lakes, at the bottom of which we, within the last few years, have found the vestiges of an ancient culture in Switzerland, then in Italy and South Germany. Possibly they did so from fear of wild animals, or not to be surprised by enemies. But, at all events, we must admire the skill with which the pile-works have been constructed, as well as the implements : recollecting that the oldest of the latter belong to a period when the use of metals was unknown. In the Malay Archipelago a similar position has been selected for habitation, as a protection against tropical rain. Thus Venezuela is built on the lagunes of Maracaibo ; and the town of Bruni, in Borneo, is also built in that manner. A. v. Humboldt has given a remarkable description of the mode of life

of an Indian tribe on the water. The people of the Gueraunas, on the Orinoko, live during times of inundation, when innumerable animals are destroyed, upon trees, upon which they hang their hammocks, and, covering them with earth, kindle fires in them, to the surprise of the by-passing navigator.

The inundation caused by streams, which the savage tries to escape, has, however, for some civilised peoples become a blessing by fertilising the land. Egypt, formed in part by the alluvium of the Nile, and, as Herodotus said, a present from it, has from the most ancient times ordained its course of life in harmony with this natural event. The whole country is intersected by deep canals, which facilitate the deflux of the waters ; but the Nile mud, an excellent manure, according to recent analyses of a French chemist, fertilises to this day the fields, bringing forth plentiful crops. What destruction would not the rapid Po (in its short course from the Alps to the sea, carrying away so much gravel and mud, as annually at its mouth to drive back the sea for 250 feet) have caused, were not its course hemmed in by dykes ? The river often flows eight to ten feet above the Lombard plain, which is thus readily watered, and has become the garden of Italy.

We cannot quit these observations without throwing a glance on the development of navigation, a human invention which has recently been greatly improved, and founded man's dominion over the sea.

Even a small rivulet obstructs the path of man ; but he contrives to swim over. The animal does the same. Man meditates, and he finds out a better means to cross the water. We see how even the son of the wilderness contrives to make a canoe from a hollow tree ; he then adds oar and plaited mat, and by allying himself with one natural force, in order to overcome another force, he sails with the wind against the stream. Still, he does not venture far from the coast into the open sea. At a later period a large ship is constructed, which, with its keel cuts through the water and is moved by the aid of oars, sails, and the helm. But how clumsy are still the ships even of the most civilised peoples of antiquity ; of the Egyptians, Greeks, and Romans, the pictures of which we see on the coins, paintings, and sculptures of the ancients. Naval architecture remained for a long time in the same condition. Even among the ships with which Columbus discovered the new world, some had no deck. Navigation, hitherto chiefly confined to the coasts, progressed rapidly in the beginning of the fourteenth century by the introduction of the compass. The magnetic needle, which the Chinese, a thousand years before our era, are said to have used in their transit across the Asiatic steppes, indicates the direction the ship takes even when dark nights hide the light of the

stars. Science has greatly perfected navigation. A seagoing ship is, in fact, an epitome of all our inventions, a practical application of all our knowledge. The observation of the stars shows to navigators the degree of latitude under which he happens to be ; the exactly adjusted chronometer gives him the longitude. Upon his chart he finds the direction of the prevalent winds and the gulf-streams indicated. These indications are so important that, profiting by the observations of American and English navigators, the voyage from New York to Europe has latterly been shortened about a fourth, or even a third. And what changes have been produced in navigation by steam ! It was in the year 1808 that Fulton built in New York the first steamboat of twenty horse-power, which performed the one hundred and twenty knots from New York to Albany up the river in thirty-two hours. Now we possessed a vessel that, independent of wind and tide, crossed the billows ; but this steamer, with its paddle-wheels, was still capable of improvement. The hammering of the paddles upon the water shakes the vessel and impedes the working of the engine ; moreover, when the sea is high the paddle-wheels are not equally submerged, one may be high out of, whilst the other is under water. Paddle-wheels are besides exposed to injury, which in a man-of-war is a great drawback. It was then that Smith, an Englishman, proposed the screw for moving the vessel, an idea which had been already mooted by Du Ouet, Bernoulli, Ressel, and Sauvage. In September, 1837, the first screw-steamer made its appearance on a canal. It progressed without noise, no foam of waters on the flanks, nothing but a long circling wave behind the ship betrayed its motion. But the spirit of enterprise in seafaring nations has in other respects improved the art of navigation. England and America rival each other in rapidity of sailing. Stevenson in his yacht made the passage from New York to Liverpool in eight days.

Ships are now built like swimming palaces, with theatres and dancing rooms for five hundred persons, lit up by gas. Such a giant ship loads 18,000 tons, whilst formerly the largest ships were only of 600 tons register. The much admired and now finished *Great Eastern* is 680 feet long, and 87 feet broad. It can, besides her crew, receive three thousand passengers ; it has double iron plates, and twenty-four watertight compartments, so that any injury to the ship can only involve a part. The ship crosses the highest waves without any perceptible rolling. It is moved both by paddles and screws. Four steam-engines, each of 1,000 horse power, revolve the paddles, which have a diameter of 56 feet. A fifth engine of 3,000 horse power moves the screw. The ship is intended for the East India trade, and is able to carry coals sufficient for the whole voyage. Although this gigantic structure,



which at this moment is engaged to pay out the Atlantic cable, has not altogether fulfilled expectations, the attempts will not be abandoned, but will probably be improved. The application of iron instead of wood, has rendered such structures possible ; iron has also given existence to iron-clads, which for the future, as it seems, are to decide the supremacy on the sea.

Wealth, which trade brings to a seafaring people, is not the only advantage which man derives from his dominion over the element. The ship of the merchant not merely carries goods, it also carries science and art, and every means of civilisation. It carries the naturalist and the missionary to the remotest peoples of the earth, and makes them participate in the treasures of civilisation which ennobles man. And it is not unimportant to bear in mind what the history of all times has taught us, that life on the sea renders peoples free and great, for upon the high sea man is reduced to his own resources ; every moment requires presence of mind. Danger does not paralyse but excites the spirit of enterprise, although many a one finds his grave in the sea. But human ingenuity has not only found means of saving life, but for the recovery of goods swallowed up by the sea. Whole ships with their cargoes have thus been raised from rivers and seas, as at Sebastopol and Cronstadt. The diving apparatus has been latterly so much improved, that man can stay and work for hours under water by the light of the electric lamp ; and, by these means, rocks are blown up which render navigation dangerous. The dangers of the sea, especially near the coasts, are lessened by the establishment of light-houses, which are now provided with all the contrivances invented by science. The electric light produced by the galvanic current, has been several times employed when it was found requisite to work at night as well as by daylight, as has been done during the erection of new streets in Paris, and at the erection of the Exhibition building, and also during the construction of the bridge over the Rhine at Kehl. The lime light on the beacons, reflected by parabolic mirrors, exceeds that of the brightest stars ; and, although its light does not penetrate distances so great, it still is sufficient to guide the ship through rocks and shallows to the safe port.

It is to the honour of our philanthropic age, that arrangements are in progress at all our European coasts to assist the wrecked. It forms a contrast to the treatment which the shipwrecked have to expect on the inhospitable coasts inhabited by savages. As late as 1858, it happened that some hundreds of shipwrecked Chinese, on one of the South Sea islands, Rossel, were killed and eaten by the natives. The good effected by the establishment of life boat stations is great. According to a recent Report, published by the Danish government,

1,302 lives have been saved on the Danish coasts since 1851. In 1860 alone, two hundred were thus rescued. From the last Report of the Life-Boat Institution, founded in England in 1824, it appears that, from 1824 to 1863, not less than 13,568 lives have been saved, frequently under the greatest dangers, owing to the high seas and hurricanes. Out of 714, 417 were in 1863 saved by the life-boats of the society, and £1,308 were voted to other boats, by which the remainder were rescued. The arrangements are so admirable, that hitherto none of the crew of a life-boat have perished. Peak's life-boat, being at the same time light, strong, and self-righting, has during the last fifteen years maintained its reputation. Where a boat cannot approach, use is made of the rocket apparatus, by which a rope is thrown to the foundering ship, and the crew rescued by means of a gliding basket. Similar establishments have latterly been founded on the coasts of East Friesland, Hamburg, Bremen, and more are in course of formation.

The destruction of human life caused by the sea may be computed from the reports of a single country. In 1853, there perished on the coasts and rivers of Great Britain and Ireland not less than 989 human beings, by the foundering of 832 vessels. In 1863, the shipwrecks on the English coast amounted to 1,602, when 568 lives were lost. It must, however, be recollected that 300,000 ships annually enter the ports of Great Britain. Mishaps on the sea also become rarer, as by the aid of the telegraph the occurrence of storms is predicted. Storm-signals are now given on both the English and the North German coasts. Though man cannot secure his life, he has contrived means to secure himself against the loss of his property. This is the fundamental idea of assurance offices, by which we are protected from losses by water, fire, hail, and lightning. Not that any of these natural forces are resisted by the insurance offices, but they simply afford compensation for damage. As our own death may leave others helpless, we have, by insuring our own life, the power of mitigating the lot of those we leave behind.

Perhaps more dreadful and unconquerable than in the element of water, nature appears to us in the element of fire. The highest god of the Greeks, Zeus, sends down lightning and thunder; the eagle hovering in the clouds, holding the lightning in its claw, is still the symbol of royal power. And, nevertheless, man learned to protect his house from the kindling stroke, which, now powerless and obeying man's will, sinks along the conductor into the earth. And yet, although the volcanic eruptions terrify mankind, burying their cities under lava streams, devastating their fields; despite the destructive power of this element, the fire that Prometheus stole from heaven,

the fire guarded by vestals, and which is still worshipped by the Persians, is to man more a beneficent than a destructive force. The fire on the hearth was to the ancients already a picture of domestic felicity ; and what would human life be without the manifold uses of fire ? The savage may procure it from a tree struck by lightning, or by friction of inflammable materials. In Virgil's *Æneid*, Achates strikes sparks from the flint. The facility with which we obtain this indispensable force, that furnishes us with light, cooks our victuals, melts our metals, by means of an insignificant box of lucifers, is significative of the present state of our civilisation. According to Stuart, the Southern Australians rub dry grass between two wooden sticks to make a fire. Such a proceeding is unknown to the northern tribes ; who, therefore, keep the fire up, and should it by some accident be extinguished, they undertake long journeys in order to recover it from some other tribe.

Water and fire are the forces which have produced the greatest effects on nature. They have, either by deposits or by upheavals, given shape to the surface of the earth, and are still constantly at work. Moisture and heat are the most important conditions of organic life. The force which enables man to perform the most stupendous works, namely, steam, is nothing else than water transformed into air by the agency of fire. The neatly constructed locomotive engine running upon our railroads, this snorting fire-horse, does the work of three hundred steeds. What does not steam perform for us ? It pumps water, drives ships, draws waggons, paints, spins, weaves, forges, hammers and rolls, presses, ploughs, sows, and reaps. The steam-engines of England and Ireland represent a muscular force of ten millions of men, or two millions of horses. Could as many horses be employed ? A horse requires eight times as much land as a man for its nourishment ; but, as engines are used instead of horses, it follows that sixteen millions of men more can be fed.

We are in the habit of ascribing certain inventions to certain men ; but often it was a mere happy addition, by which they improved what others had long prepared for them. It is in the mental as in the corporeal world, nothing exists all at once ; from a small beginning grows a whale. Just as the more perfect plants and animals require a longer time for their development, so the fruits of the human mind require centuries ere they come to maturity. The invention of the steam-engine by James Watt in 1769, was preceded by various attempts to use steam as a motor force, by such men as Blasco de Garay, Salomon de Caux, whom Richelieu sent to Bicêtre as being insane, by Worcester, Papin, Savery. The engine of the latter was improved by Newcomen, and after him by the boy Potter, who turned stop-cocks, who

contrived by attaching cords and catches to admit and cut off the steam. Watt further improved it by adding the condenser and regulator. The first steam-engines were employed to raise water from the mines. In the year 1778, Cugnot constructed the first locomotive, to run on common roads. It was then used on tramways. Blckett and Stephenson then demonstrated that a smooth wheel can run on smooth rails. Seguin diminished the size of the boiler; Pelletar increased the draught by conducting the used-up steam into the chimney. By degrees the consumption of coals was diminished by one-half. It was ascertained that steam produced by higher pressure assumes greater expansive force, and this led to the invention of the high-pressure engine. It was once thought that railroads could only be made on plains, and that they must run straight. At present the locomotive crosses the Alps, and runs in curves. Thus there is a constant progressive improvement in all human doings. Are there limits beyond which we cannot pass? That much yet remains to be done, may be inferred from the fact that even in our best engines coal is still wasted; for, according to W. Armstrong, in these engines one pound of coal produces a force which in a minute raises a million of pounds one foot, whilst from calculation ten millions of pounds ought to be raised. But suppose the supply of coal should fail us, is there another force to supplant that of steam? Perhaps electric force, or we may succeed by a simple process in decomposing water, and use its hydrogen for combustion. Ericson has employed heated air, and Lenoir gas, as motor forces. In England, parcels and letters are despatched by condensed air.

Let us glance at another spectacle, which presents man's struggle with the animal and vegetable world. In the history of our race, we find first, man in combat with animals—a hunting life is the first stage of man's culture. This is followed by a pastoral life; after which he becomes an agriculturist, and rears plants for his nourishment. He acquires a fixed settlement, trade and industry, art and science, succeed each other; and man finally, by mental labour, reaches the highest step in civilisation, which looks out for higher objects.

The dangerous arts of the beast-tamers, which now surprise us, show the great power possessed by man over the largest and most savage beasts of prey. Even in ancient times, at the beginning of history, man issued victorious from this struggle. We hear of a Nimrod, who was a mighty hunter before the Lord, who cleared the land from wild beasts; of Hercules, who strangled the lion. Of the deeds of the heroes of our own country, whose whole life must have been in remote ages a struggle with the mighty mammals, the bones of

which are found intermingled with human implements, we possess no documents singing their praise ; and yet they probably killed the last mammoth, and tamed the wild cattle. They performed the most difficult part of culture, a gigantic work for which our muscular force is scarcely adequate. The *Nibelungenlied* (speaking of the urus), the wisent, the elk, and the grim “*Schelch*”, speak of a much later period. It has only lately been admitted that the wild beasts have had their share in the education of the human species. The struggle of man with beasts has essentially contributed to the development of man’s physical force and beauty ; it has called forth his courage and bravery. Asia, the home of lions and tigers, has first given rise to mighty peoples. The African Negroes, among whom the lion is at home, are the most powerful of savages. The Americans, compared with these peoples, seem a much weaker species, as their fights with the puma and the jaguar, the much smaller carnivora of the New World, are less apt to call forth their physical forces. Finally, the Australians, a decaying stock, had in their country no large animals dangerous to them ; when Cook found them, they even did not know how to hunt the kangaroo. Man can tame all animals. Hyænas have been described as untameable ; but in the oasis of Cordofan they are domesticated like the dog. The old Indians rode on the backs of lions and leopards ; they still train small tigers for hunting. Frederic Barbarossa kept some which sat behind the horseman, and leaped down upon an animal on a given sign. Some North American Indian tribes hunt with trained wolves. The taming of some of our domestic animals, which certainly have not been created as such, as has been asserted, seems to have been the labour of thousands of years ; for the nature of the wild beast has been almost entirely changed. The wild horse of the South Russian steppes is so savage that it seems almost impossible to tame it. The horse was but very gradually trained for our use. The pictures of Persepolis show no horsemen ; even in Rome horses are only used to draw chariots for battle. Cyrus, the Persian king, first introduced horsemanship ; but the tradition of Centaurs indicates that there may have been horsemen in ancient Thracia. Although at the time of Moses horses existed in Egypt, yet the Egyptians are not upon the Egyptian monuments represented on horseback, but their enemies, the Arabs and Indians, are so pictured. The finest and noblest race, according to our notions, the Arabian horse, is only the produce of the great and long continued care bestowed upon the breeding of the animal, which is, in fact, his companion in the tent of the Arab. Domestic animals have also their history. Upon an old Egyptian picture the ram is employed in tilling the land, and it is only within a few centuries that the horse has commenced supplanting the ox at the plough.

The large beasts of the forest first disappear before man ; either because they are more dangerous, or because, requiring most food, they limit the supply requisite for the support of man. Thus the elephant of Northern Africa, which Hannibal led with his army over the Alps, has entirely disappeared from that part since the end of the fourth century, although lion and tiger hunting was in the Roman period an imperial privilege. Thus the bear has disappeared from Germany, where, for a long time, he was looked upon as the largest hunting animal, and styled in the old songs the king of beasts. The aurochs would long have become extinct in Europe had not the Russian government protected a herd in the Beutowitz forest. The Ibenhorst forest is the only one in Germany where the elk, the last of which was in 1746 shot in Saxony, still exists. The free chase in 1848 has almost exterminated the herd, numbering about four to five hundred. In 1858 the number again amounted to from eighty to one hundred heads. Even the whales, in the capture of which almost all seafaring people are engaged, have diminished in number, and must now be pursued in more distant regions. To the destruction of this largest of all animals the wrongly so-called weaker sex have much contributed. Blubber and whalebone are the most valuable articles of the animal. The price of the latter has greatly risen in consequence of its consumption for making stays ; and if it had been used for making crinolines, whales would soon become extinct. The physical force which man wants in this unequal struggle he supplies by craft and skill. To lead large animals into traps in order to kill them is even the work of the weakly savage. Cunning and craft are used both by cultured and uncultured peoples. The Esquimaux, disguised in the skin of a seal, approach the animals lying on the shore, and kill them unaware. Abdel Kader tells us that the Arab approaches the ostrich disguised in the skin of that large bird, and succeeds in killing it. Even the most advanced art still invents new methods to overreach animals. Angle fishing has become more productive and more entertaining since the predilection of the various kinds of fishes for different insects and worms has been ascertained, so that these are artificially produced to serve as baits. In the absence of the requisite physical force to overcome the beast, nature offers another means—poison. The Indians on the Amazon river kill animals by arrows poisoned with curare, a kind of chase, which is also indulged in by Europeans travelling in these parts, and which singularly enough is not unknown among the natives of Borneo, as well as in the Himalaya mountains. This dreadful poison does not render the flesh of these animals unfit for food, and is in these countries as much an article of trade as gunpowder is amongst us. The period of preparing this poison is one of festivity just as the vintage time with us.

This battling against beasts imparts to people a feeling of self-reliance ; the deeds are sung in poems and illustrated by art. Animals from all countries were collected in the Roman arenas, and attended the triumphal processions, by which the Romans acquired the consciousness that they ruled the world. Hundreds of lions, panthers, ostriches, crocodiles, giraffes, bears, and wild boars were destroyed in the circus. Even from England were exported auroxen, elks, and dogs for the use of the Roman circus. The dogs were, on account of their savageness, transported in iron cages. Passionately is the Spaniard still attached to his bull-fights, a remnant of the spectacles of the Roman circus. How soon before the progress of culture wild beasts disappear is shown by England, where, on account of its insular position, access from foreign ports was impossible. In 1680 the last wolf was shot in Scotland, where a century before wolf-hunts took place. The fox, which from its wariness frequently escapes, has, for the amusement of fox-hunters, several times been imported from France. Moreover the fox is merely hunted, not shot. Since the introduction of guns hunting animals are much more liable to destruction. If we did not protect the game in our fields and forests by sparing them during fixed periods, and by game licenses, they would soon become extinct. But some arrangements have only become requisite by the increase of the population and the progress of culture. It was only in the year 1856 that in Russia by an imperial ukase, it was forbidden, in consequence of the great diminution of game, to hunt in the governments of St. Petersburg, Novogorod, and Pskow, from the 1st of March to June 13th. But that luxuriant and abundant nature, despite the exterminating wars of man, preserves animal life in many instances, is shown by the herring fishing, which is so extensive that the Dutch alone cure above two thousand millions. No diminution of their number has yet been observed, They come in shoals five to six English miles long, and two to three miles broad, often so close that a spear thrown upon the mass remains upright. There seems to be an increase in the number of wild elephants in India ; for only last year the English government was called upon to adopt measures for their destruction in some parts of Ceylon, where they caused great devastations. And yet one hunter alone has killed more than 1,400 elephants, and in England such a quantity of ivory is worked that for its supply 8,333 elephants must be destroyed. One portion of the ivory in trade is derived from the teeth of the antediluvian mammoth found in Siberia.

Unfortunately we see the descendants of civilised peoples, when engaged in the struggle with the vegetable and animal world in regions where they form settlements, relapsing into barbarism. They

not merely exterminate the wild beasts, but also the savages who defend their hunting grounds. The Spaniards in America hunted the native Indians with bloodhounds, just as in our days the runaway slaves are tracked in North America. The natives were shot down like wild beasts in Texas, California, South Africa, and Australia. Collins states that an otherwise respectable man at the Cape assured him that within six years he and his people had captured and partly killed more than 3,200 Bushmen.

It would not be just to speak only of the large animals which attack man, and not of the smaller creatures which are a great plague to him and from which he is less able to protect himself. Man cannot effect much against caterpillars and field-mice, when they appear in large numbers. His only comfort is that these creatures appearing, from as yet recondite causes, periodically in prodigious numbers, they disappear as suddenly. Owls and sparrow-hawks, which we have nearly exterminated, and other smaller birds which we destroy, would have better limited the devastations caused by those small animals than any means devised by man. Southern countries are more exposed to such visitations; Asia Minor, Egypt, and Hungary have suffered much from locust swarms. In 1748 they also devastated several parts of Germany, and of Southern Russia. But their appearance is not everywhere looked upon as a misfortune. In the east, as well as in Chili and in the Philippines, they are eaten, and Livingstone says they are a blessing for some districts of South Africa, where animal food is scarce. One of the most dangerous animals to human culture would be the large white ant if it should spread amongst us, having already once found its way into the magazines of Rochefort. It destroys every vegetable substance, neither papers nor books can be protected from the termites; and it is stated that for this reason no manuscript can be found in India older than three hundred years. All kinds of wooden structures, such as beams, tables, and implements, are within a short time hollowed out by them; but, as they leave the outside uninjured, the internal destruction is not perceived until the whole is accomplished. The minute animal world even pursues us on the sea. There we have the ship-worm destroying the wooden walls, which we try to protect by saturating the wood with creasote or by copper-plating. This species of worm causes so much damage that the Dutch government has lately called upon naturalists to more accurately investigate the mode of life of this animal so as to render it less noxious.

When man goes into battle with animals he frequently makes an ally of such as he has domesticated either for his alimentation or for labour. To some rude peoples certain animals are more indispensable than domestic animals are to us. The Lapp could not exist in the north



without the reindeer ; but a man with a small family must, according to C. Brook, possess two hundred reindeer to make the two ends meet. In summer he must leave the interior of Finland with his herds for the coast, because of the gad-fly which torments his herd. The Canadian in a snow-storm is only saved by his little dogs, which rapidly draw his sledge across the icy surface. With the swiftness of an arrow he drives through the frigid solitude, where, as in tropical deserts, thirst torments him, for snow does not quench it. Hence travellers carry kettles with them to melt the snow. If he is obliged to pass the night in the open air, he buries himself deep in the snow, his gun by his side, his dogs above him, they keep him warm, and protect him from wolves. The Tebu-nomad could not cross the Sahara without the camel, the ship of the desert. It can run twenty miles within an hour ; neither does the rider on its high back feel the great heat reflected from the soil. The dromedary can live nine days without water, which it smells at a distance of three miles, and of which it can imbibe thirty quarts at once.

On passing from the animal to the vegetable world, we see man, though not exactly battling, yet working hard to derive from plants nutriment, clothing, and fuel. He also prepares from them weapons, implements, habitations, medicines, poison, and intoxicating liquors. Vegetable food and agriculture give rise to milder dispositions than animal food and a hunting life. Cotton is much more extensively used than the wool of animals ; and whilst the existing forests provide us with wood, the buried forests of the past furnish the still more valuable coal. Man has as much changed the surface of countries by his influence on the vegetable world as by his dominion over animals. He clears the primitive forests, and sows cereals as he extirpates wild animals in order to graze his flock. He forces the soil to greater productiveness ; but he may exhaust it, unless he finds means of compensation. Man may deteriorate the climate, and lessen the fertility of a whole region if he proceeds recklessly and clears the hills of all forests. In Switzerland it was found necessary by laws to protect the forests. They obstruct the lavines from the mountain slopes, they are a protection against the cold winds, so that fruits and cereals can better thrive on the elevated land. Under Frederick William I, the forest which covered the low ground between Pillau and Danzig was cut down for some financial reason. It realised two hundred thousand dollars ; but now millions would be given if it were still existing ; for the bay is filling up with sand. The destruction of the forest in Moldavia by Russian invasions has exposed that country to north-east winds, and changed many formerly fertile districts into steppes. How frequently have famines shown the dependence of man on the products

of the fields. Although the population of Europe may be double of what it is, we need scarcely much fear a famine on account of the great variety of nutritious plants now cultivated and from the increasing facility of intercourse. Where nature refuses the soil man creates one. The Phœnicians crushed the rocks of Malta, as do the Chinese now in their country to fertilise the ground ; where, on account of drought, no grass can grow, man raises water from the depth. The French have in the Eastern Sahara between 1856 and 1860 dug not less than fifty artesian wells, and planted thirty thousand palm trees. When the Arabs saw this, they, who gladly renounce a nomadic life when they can settle near date-palms, fell on their knees and worshipped and called the wells "wells of peace." We also bore for wells to provide large cities. The well of Grenelles yields 5,000 cubic metres in twenty-four hours ; that of Passy, 25,000 ; these 30,000 cubic metres, taking the population of Paris at 1,200,000 souls, furnish 25 litres to each inhabitant.

Whilst the existence of the vegetable world thus forms an indispensable basis for human culture ; there are, nevertheless, minute scarcely perceptible plants which can destroy the prospects of whole countries, and even threaten the health and lives of men and animals. They effect this by becoming the causes of disease, such as the potato- and the grape-fungus.

Since 1852 the grape fungus has caused such devastation that Madeira, which formerly exported fifteen millions of bottles, exports scarcely any since 1865, so that the sugar-cane is now being cultivated, although hopes are entertained to import at some future time new vines from Cyprus. Recent researches have shown that microscopic animal life may be the cause of noxious phenomena. Liquids and aliments become corrupt by fermentation and putrefaction. Fungi appear in the former, monads in the latter. Vibriones are found in the blood of scabby sheep. Trichinasis in the swine threaten the life of man. Thus this man, who extirpates the primitive forests and the largest beasts of prey, is nearly helpless in the presence of microscopic creatures, which cause such devastations not by their strength but by their number and their great productiveness.

It is remarkable that also among the larger plants those which oppose us are mostly those of an imperfect species. Thus we try to protect our roofs and walls from mosses and lichens, and the wood from fungi. In hot zones the luxuriant growth of the vegetable world constantly, and with gigantic force, tends to the destruction of man's work. In Central America the ruins of mighty cities have after a few centuries been overwhelmed by vegetation ; in fact, buried under it ; and they have thus disappeared even more rapidly than the peoples who built them.

We also struggle with numerous diseases and pestilences, formerly looked upon as divine chastisements. No doubt medical science may benefit the individual affected, but taken on the whole medical science, as statistics show, has hitherto had no perceptible influence on mortality. Physicians stand helplessly before wide-spreading pestilences. We see them come, grow, and attain a climax, and then decline, and finally disappear like other natural phenomena. There is one formidable disease which, although the medical art has not been able to destroy, yet has greatly mitigated, namely, the small-pox. Of all the homages done to the noble Jenner, to whom Parliament has awarded £30,000 as a benefactor to mankind, the message from five savage Indian tribes who had suffered from the pestilence may have been most acceptable to him. We also owe to medical science the knowledge that many of these diseases are owing to causes which it is in our power to obviate. A German physician who has travelled over the globe for the purpose of investigating the causes of epidemics, says: Pestilences are not exactly the creations of nature, man himself has contributed to produce them. The large cities, over-populated and in misery and dirt, corrupting the air and the water,—these are the breeding places of contagious and deadly poisons.

We gladly turn from such lamentable pictures, the dark shades of which even the bright light of our civilisation cannot remove.

The strongest limits set by nature to human activity, by which all that we have done always lags far behind what we intended to do, are space and time. The dominion of man over nature has, indeed, not annihilated time and space as we are accustomed to boast, but it has greatly reduced them. Into what immense distances does not man penetrate, and what is time when we send our thought around the globe by the electric wire? The prediction of Fichte is near its fulfilment, who said, "When everything useful that is found in one end of the world is immediately communicated to all men, then will humanity, uninterruptedly without rest or retrogression with united power, rise to a development of which we at present have scarcely any notion." A New York paper lately said: we travel by steam, we paint with light, and write with lightning; how many other wonders does not man work!

Man in his balloon rises 34,000 feet in the air, 5,000 feet higher than the highest mountain on the globe. He casts his plumb-line 50,000 feet into the sea, and brings up the ooze. He weighs the earth, and finds that it weighs fourteen quadrillions of pounds. By the spectro-scope he recognises the materials in the photosphere of the sun at a distance of 20,000 geographical miles. He fuses flint, lead, and potash, and produces a lens by which he discovers both the wonders of

the starry world and those of minute microscopic life. With improved instruments he is able to determine  $\frac{1}{1000}$  degree of heat, to measure  $\frac{1}{2000}$  line, to weigh  $\frac{1}{10000}$  gramme. From coal-tar he prepares the most splendid colours; from shavings, brandy. He blasts rocks by means of gun-cotton; he builds machines which work better and more rapidly than human hands. But is not all science a struggle for liberty, a struggle with nature, in order to take from her what she would deny us, and to reveal to us what she has concealed from us. Whatever man knows, whatever he produces, whatever is noble in his breast, all this is merely acquired by labour; for the workings of nature are done in secret. The inert matter resists the formative power of man, and the necessities of the body always draw our senses downwards.

We have seen man in his struggle with the elements of nature, with animals and plants; but that enlightenment of our intellect by science struggling for truth, the representation of the beautiful which glorifies reality by art, and finally the moral force which subdues passion and rude instinct—these constitute the noblest victories of man over nature.

## ON A HUMAN JAW FROM THE CAVE OF LA NAULETTE, NEAR DINANT, BELGIUM.

By C. CARTER BLAKE, Esq., F.G.S., Hon. Fellow of the Anthropological Society of London; Foreign Associate Anthropol. Soc. of Paris, Spain, and Moscow.

IN the autumn of 1866, the Council of the Anthropological Society confided to me a mission to the Wallon district of Belgium, to investigate in co-operation with our energetic Local Secretary at Brussels, Mr. John Jones, F.G.S., the recent excavations made by Dr. Edouard Dupont, of Dinant. My report on this subject, comprising minute details of the geology of prehistoric archæology of the district, was read before the Anthropological Society on Nov. 20th last, and has been passed for insertion in the *Memoirs* of the Society. As in the meanwhile great interest has been excited with reference to the jaw from La Naulette; and, as its more or less simious character has attracted great attention, I have, with the sanction of the Council and Publication Committee, been permitted to publish that portion of the memoir which relates to the Naulette jaw in the present form, without waiting for the publication of the next volume of *Memoirs*.